SpectraLink 8020/8030 Wireless Telephone

Administration Guide

SpectraLink 8000 Telephony Gateway and SpectraLink Radio Protocol (SRP)

January 2008 Edition
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Version B

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Contact Information

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About this Guide

This document explains how to configure and maintain the SpectraLink 8020/8030 Wireless Telephones (handsets) when used with the SpectraLink 8000 Telephony Gateway.

Polycom Model Numbers

This document covers the following model numbers:

802X, 803X

Related Documents

SpectraLink 8000 Telephony Gateway: Administration Guide (1725-36028-001)

SpectraLink 8000 SVP Server: Administration Guide (1725-36032-001)

SpectraLink 8020/8030 Wireless Telephones Handset Administration Tool (1725-36039-001)

SpectraLink 8020/8030 Wireless Telephone and Accessories User Guide (1725-36023-001)

Available at http://www.spectralink.com/resources/manuals.jsp.

LinkPlus Interface Guide (1725-361xx-001 where xx indicates a number corresponding to the type of PBX)
Available at
http://www.spectralink.com/resources/interface_guides.jsp.

SpectraLink 8000 System Wireless Telephone WLAN Compatibility List (1725-36040-001)

Access Point Configuration Note (1725-36xxx-001 where xxx indicates a number corresponding to the type of access point.).

Available at
http://www.spectralink.com/resources/wifi_compatibility.jsp.

Deploying Enterprise-Grade Wi-Fi Telephony white paper.

Available at
http://www.spectralink.com/resources/white_papers.jsp.

Contacting Polycom

Polycom wants you to have a successful installation. If you have questions please contact the Customer Support Hotline at (800) 775-5330. The hotline is open Monday through Friday, 6 a.m. to 6 p.m. Mountain time.

Icons and Conventions

This manual uses the following icons and conventions.

Caution! Follow these instructions carefully to avoid danger.

Note these instructions carefully.

Label

This typeface indicates a key, label, or button on Polycom hardware.

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1

SpectraLink 8020/8030 Wireless Telephone Overview

SpectraLink 8020/8030 Wireless Telephones are mobile handsets for workplace telephone systems. The handset operates over an 802.11a/b/g wireless Ethernet LAN providing users a wireless voice over IP (VoIP) extension. By seamlessly integrating with the SpectraLink 8000 Telephony Gateway and the facility's telephone system, handset users are provided with high-quality mobile voice communications throughout the workplace. The handset gives users the freedom to roam throughout the workplace while providing all the features and functionality of a desk phone.

The handsets reside on the wireless LAN with other wireless devices using direct-sequence spread spectrum (DSSS) radio technology. The handset radio transmits and receives packets at up to 54Mb/s.

All Polycom products use the company's LinkPlus integration technology to connect with various digital switch platforms. Using LinkPlus technology, handsets emulate digital telephone sets to deliver advanced capabilities such as multiple line appearances and LCD display features. See the *LinkPlus Interface Guide* for your PBX for information about mapping the PBX features to the handset.

SpectraLink Voice Priority (SVP) and Quality of Service

SVP is the SpectraLink quality of service (QoS) mechanism that is implemented in the handset and access points (APs) to enhance voice quality over the wireless network. SVP gives preference to voice packets over data packets on the wireless medium, increasing the probability that all voice packets are transmitted efficiently and with minimum or no delay. SVP is fully compatible with the IEEE 802.11 standards.

The SpectraLink 8000 SVP Server is an Ethernet LAN device that works with the APs to provide QoS on the wireless LAN. Voice packets to and from the handsets are intercepted by the SpectraLink 8000 SVP Server and encapsulated for prioritization as they are routed to and from an IP telephony server or gateway. See *SpectraLink 8000 SVP Server: Administration Guide* for detailed information about this device.

When the system employs four or fewer SpectraLink 8000 Telephony Gateways without a SpectraLink 8000 SVP Server, the SpectraLink 8000 Telephony Gateway(s) provide SVP QoS. In this configuration, the handsets are limited to a maximum of 2Mb/s. If the 11Mb/s transmission rate is desired, a SpectraLink 8000 SVP Server must be added to the system. Note that if any 2Mb/s SpectraLink 8000 Wireless Telephones are in use (model PTB5xx) the SpectraLink 8020/8030 Wireless Telephones will automatically limit speed to 2Mb/s to maintain compatibility.

SpectraLink 8020/8030 Wireless Telephone Security

SpectraLink 8020/8030 Wireless Telephones support basic Wi-Fi Multimedia (WMM) as part of the 802.11e protocol. If the AP supports WMM, the handset automatically discovers and uses it. WMM does not replace the SpectraLink 8000 SVP Server as described in the following paragraph. WMM settings must be configured on the SpectraLink 8000 Telephony Gateway and on the SpectraLink 8000 SVP Server.

SpectraLink 8020/8030 Wireless Telephones also support the 802.11i protocol including Wi-Fi Protected Access (WPA and WPA2) pre-shared key (PSK). As vendors introduce APs that are eligible to become Wi-Fi Certified for WPA-PSK and/or WPA2-PSK, Polycom will determine their compatibility with the handsets and include them on the *SpectraLink 8000 Wireless Telephone WLAN Compatibility List.*

The SpectraLink 8020/8030 Wireless Telephones support Wired Equivalent Privacy (WEP) as defined by the 802.11 specification. Polycom offers the product with both 40-bit and 128-bit encryption.

The latest software versions are required to support the features described in this document. See Chapter 3 *Software License and Protocol Management.*

IP multicast addresses are used by the SpectraLink 8030 Wireless Telephone. This requires that multicasting be enabled on the subnet used for the SpectraLink 8020/8030 Wireless Telephones, SVP Server, and Telephony Gateways.

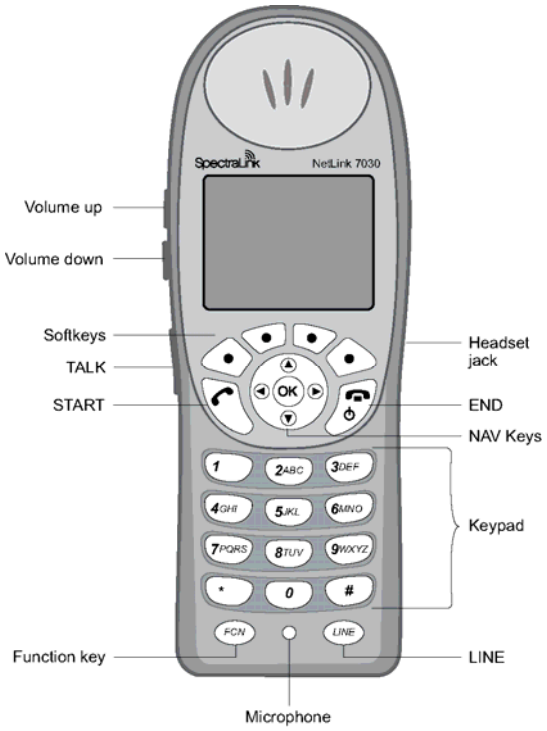
Routers are typically configured with filters to prevent multicast traffic from flowing outside of specific domains. The wireless LAN can be placed on a separate virtual LAN (VLAN) or subnet to reduce the effects of broadcast and multicast traffic from devices in other network segments.

Quick Start Overview

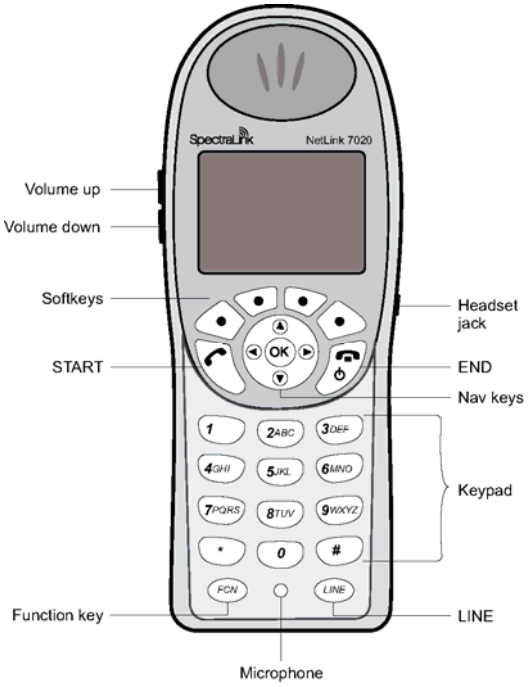
1. A wireless LAN must be properly configured and operational through the use of 802.11 wireless APs.
2. A SpectraLink 8000 Telephony Gateway must be available on the network and the handset must be registered to it in order to load the appropriate software into the handsets. A separate network TFTP server is required to distribute software to the handsets.
3. The SpectraLink 8000 Telephony Gateway and SpectraLink 8000 SVP Server must be on the same subnet as the handsets and have the proper versions of software.
   a. Download updates to the SpectraLink 8000 SVP Server software (if the SpectraLink 8000 SVP Server is installed) per *SpectraLink 8000 SVP Server: Administration Guide* Chapter 5 *Software Updates*.
   b. Download updates to the SpectraLink 8000 Telephony Gateway software per *SpectraLink 8000 Telephony Gateway Administration Guide* Chapter 19 *Software Maintenance*.
4. Configure the SVP Server per *SpectraLink 8000 SVP Server Administration Guide/*
5. Configure the SpectraLink Telephony Gateway per *SpectraLink 8000 Telephony Gateway: Administration Guide*.
6. Download the correct SpectraLink 8020/8030 Wireless Telephone software per Chapter 3, section *Configuration Process*. Ensure the software is properly loaded on the network TFTP server.
7. Configure your handset to ensure that it associates with the wireless LAN, has the appropriate software and is registered to

the appropriate SpectraLink 8000 Telephony Gateway. See Chapter 2 *SpectraLink 8020/8030 Wireless Telephone Configuration.*

SpectraLink 8020/8030 Wireless Telephone



SpectraLink 8030 Wireless Telephone

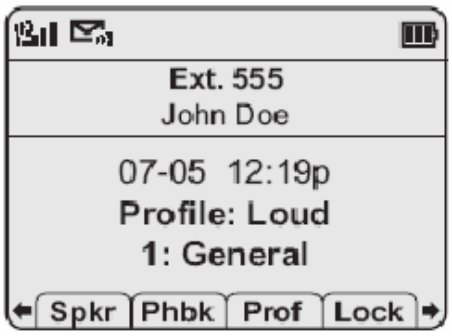


SpectraLink 8020 Wireless Telephone

SpectraLink 8020/8030 Wireless Telephone Specifications

Radio mode (selectable)	(See *Appendix A: Regulatory Domains*)
Transmission type	Direct-sequence spread spectrum (DSSS)
Transmit data rate	up to 54 Mb/s
Radio QoS	SpectraLink Voice Priority (SVP), WMM
Wireless security	Wired Equivalent Privacy (WEP), 40-bit and 128-bit; Cisco FSR; WPA-PSK, WPA2-PSK
FCC certification	Part 15.247
Voice encoding	ADPCM (Proprietary)
Transmit power	See *Admin menu*
Display	Up to five lines of text plus two icon status rows and one row for softkey labels.
8020 Dimensions	5.7" x 2.0" x 0.9" (14.5 x 5.1 x 2.3 cm)
8030 Dimensions	5.4" x 2.0" x 0.9" (13.7 x 5.1 x 2.3 cm)
8020 Weight*	3.9 oz. (110.6 g) with Standard Battery Pack
8030 Weight*	4.2 oz. (119.1 g) with Standard Battery Pack
Standard Battery Pack capacity	4 hours talk, 80 hours standby
Extended Battery Pack capacity	6 hours talk, 120 hours standby
Ultra-Extended Battery Pack capacity	8 hours talk, 160 hours standby

Handset Display



Standby mode display

Second set of softkeys

In the standby mode the handset displays status icons on the top row, the next two rows display user information, the three rows below that display the date and time, the profile and (for the 8030 model) the Push-to-talk default channel. The bottom row displays available softkeys. When more than four softkeys are available, arrows appear on either side of the softkey labels as illustrated above. Use **Nav** ► and **Nav**◄ to display additional softkey sets.

Display information provided by the PBX when the handset is off-hook will be passed directly to the handset main display. Certain characters may be used by the PBX that are not implemented in the handset, such as definable and special characters. See the *LinkPlus Interface Guide* for your PBX for information about how the handset emulates the features of the PBX utilized at your site.

Feature display

In active mode, the softkeys will be determined by the programming of the SpectraLink 8000 Telephony Gateway. Pressing the **FCN** key will display each set of programmed softkeys. Pressing it repeatedly will scroll through all four sets, or as many softkeys as have been programmed.

LINE display

Most, but not all, PBXs allow for more than one line appearance. The line appearances are mapped to corresponding line icons across the

top of the handset display. Press the **LINE** key to display a list of available lines.

Icons and Indicators

Indicator	Function
	The signal-strength icon indicates the strength of the signal and can assist the user in determining if the handset is moving out-of-range.
	The voicemail icon is activated when a new voicemail message is received if the feature is supported by the phone emulation.
	The battery icon indicates the amount of charge remaining in the Battery Pack. When only one level remains, the Battery Pack needs to be charged.
	The speakerphone icon displays when the speakerphone is active.
1	The line indicators are associated with telephone line status and access.
	Up and down arrows are displayed when the menu has additional options above or below. Left or right arrows are displayed during editing when the cursor may be moved left or right.
	PBX ring icon. A regular telephone call is coming in.
	The Push-to-talk (PTT) ring icon. A PTT call is coming in.
	The priority PTT ring icon. A call is coming in on the priority PTT channel. This call will override any other.
	Location Service (RTLS) is enabled.
Muted	The muted indicator displays after the Mute softkey has been pressed. It indicates that the microphone is not transmitting sound. Press the Mute softkey again to unmute the microphone.
Locked	Locked indicates that the keypad is locked to prevent accidental activation. Use the **Unlk** softkey plus the # key to unlock it.
[No Service message]	If warning tones are not disabled, an alarm will sound and a descriptive message displays when the handset cannot receive or place calls. You may be outside of the covered area. Walk back into the covered area. The in-service tone indicates service is reestablished.
	The download icon indicates that the handset is downloading code. This icon only appears while the handset is running the over-the-air downloader. It appears to the right of the Signal Strength icon in the same location as the Voicemail icon.
	The download failure icon indicates that the handset has failed to download code because the code is incompatible with the handset hardware. The system will also create a system log with the message: “Download aborted, code incompatible”. When this icon appears, the handset code in the TFTP server should be updated.

Startup Sequence

The handset goes through an initialization sequence at startup. The line icons **1** through **9** display and count down as the handset steps through this sequence. This is usually very rapid. If there is difficulty at any step that prevents initialization from continuing, an error message will display and the related icon(s) will stay on. Please see the *Handset Status Messages* table at the back of this document for instructions on how to handle error messages that occur during initialization.

Icon	The icon(s) shown in bold turns off when:
12345678**9**	The handset has located and authenticated and associated with at least one AP, and is proceeding to bring up higher-layer networking functions.
1234567**8**	The handset is either configured for Static IP, or if configured for DHCP the DHCP discovery process has started.
123456**7**	If DHCP is configured, a DHCP response was received which contains a good DNS server configuration.
12345**6**	Note: Only valid on non-SRP protocol. Indicates one of the following: Static IP configuration, or SVP Server address found in DHCP response, or SVP Server address found via DNS lookup.
1234**5**	All networking functions are complete (notably, DHCP), and the handset is proceeding with establishing the SRP link to the SpectraLink 8000 Telephony Gateway.
123**4**	The SRP link is established, all network stack initialization is complete, proceeding with application-specific initialization.
12**3**	The link between the handset and the SpectraLink 8000 Telephony Gateway is established.
(no icons) **EXT. XXX**	Initialization is complete. The handset is in standby mode ready to receive and place calls.

Handset Modes

Standby mode (on-hook)

In standby mode, the handset is waiting for an incoming call or for the user to place an outgoing call. The extension number is shown on the display and there is no dial tone. In this mode, the handset is conserving battery power and wireless LAN bandwidth.

When an incoming call occurs, the handset enters a transitional state and will ring until the call is answered by pressing the **START** key or the **END** key is pressed to silence the ringing.

Active mode (off-hook)

To place a call, press the **START** key. This transitions the handset to active off-hook mode. There is a dial tone, the handset is in communication with the PBX, and the display shows information as it is received from the PBX. The user may place a call or press a softkey or the **FCN** or **LINE** key to access additional operations.

The handset is also in the active mode when an incoming call is answered.

When an incoming call occurs during an active call the handset will play the second call ringing sound until the call is answered, the caller hangs up, or the call transfers to voicemail. If **END** is pressed, the first call is terminated and the handset reverts to a full ring.

The active modes utilize the most bandwidth and battery power. To conserve these resources and allow the handset to receive new calls, return the handset to the standby mode when a call is completed by pressing the **END** key.

Configuration menu mode

Press the **Cfg** softkey to enter the configuration menu mode. When user preferences are being configured in the **Config menu**, the handset is on but is not active. It cannot receive calls while in the **Config menu**.

Push-to-talk (PTT) mode

The SpectraLink 8030 Wireless Telephone utilizes channels for incoming and outgoing radio communication. PTT is enabled by the system administrator and may be activated or deactivated by the user in the **Config menu**. While PTT is active, the handset is in PTT mode. It can receive regular phone calls in this mode. When a regular phone call is answered, the handset enters active mode.

Messaging mode

Messaging mode is activated by the system administrator. If text messaging functions have been programmed, as in a nurse call system, the handset is able to receive text messages. While these messages are being accessed, the handset is in messaging mode. Incoming calls will ring with the second call ringing sound.

Notes on Battery Packs

- Battery Pack life will vary depending on handset model and features and system infrastructure.
- Maximum Battery Pack performance is achieved after a few charge/discharge cycles.
- If multiple Battery Packs are supplied with your handset, Polycom recommends that each be fully charged upon receipt to prolong battery life. Battery Packs will slowly lose charge if unused. To maintain battery potential, charge unused Battery Packs occasionally or alternate Battery Pack use.
- After a length of time Battery Packs will lose the ability to maintain a charge and to perform at maximum capacity and will need to be replaced. This is normal for all batteries.

2

SpectraLink 8020/8030 Wireless Telephone Configuration

Prior to configuring a SpectraLink 8020/8030 Wireless Telephone, it must be associated with one and only one line on one of the SpectraLink 8000 Telephony Gateways. Then it must be configured per the instructions in this section. The following instructions assume that the handset has been properly associated with a line on a SpectraLink 8000 Telephony Gateway. See *SpectraLink 8000 Telephony Gateway: Administration Guide* for additional information. While handsets are being associated, the system will continue normal operation.

Use the *Wireless Device Planning Worksheets* filled out by the network or system administrator to be sure you are correctly assigning telephone parameters.

The SpectraLink Handset Administration Tool is a software utility that enables rapid configuration of handsets by utilizing the USB port on the Dual Charger. See the *Handset Administration Tool* document for specific instructions. Please see your service representative or contact Polycom customer service for more information about this time-saving tool.

The Admin Menu

The Admin menu contains configuration options that are stored locally (on each handset). Every handset is independently configured and if the default settings are not desired, the Admin menu options must be set in each handset requiring different settings.

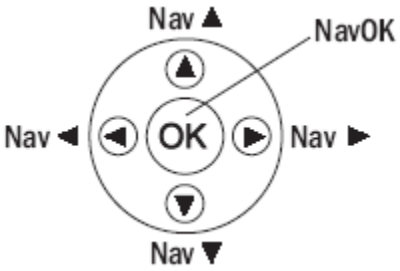
Opening the Admin menu

1. With the handset powered off, press and hold the **START** key. While holding the **START** key, press and release the **END** key.
2. When the Admin menu appears, release the **START** key.

If an admin password has been set, the display will require its entry before opening the Admin menu. The default password is 123456. If no password is set, the display will proceed directly into the Admin menu.

Navigation

The navigation keys just below the softkeys are used to navigate through and select menu options. These are referred to as **Nav▲**, **Nav▼**, **Nav◄**, **Nav►**, and **NavOK**.



Toggle options

Some menu options that have only two possibilities operate on a toggle basis. The current setting is shown on the second row of the display, called the info line. Press **NavOK** to toggle between the settings. For example, when **Enable PTT** is the menu option, **PTT Disabled** will show on the info line. If you select **Enable PTT**, **PTT Enabled** will show on the info line and the menu option will toggle to **Disable PTT**.

Data entry and editing

An asterisk (*) next to an option on the display indicates that it is selected. Use the Nav keys and the softkeys to navigate and select desired options.

Enter numbers by pressing the buttons on the keypad. The blinking underscore identifies the current cursor position. When entering alphanumeric strings, the **CAPS**/**caps** softkey will appear and may be pressed to toggle the case. Enter letters by repeatedly pressing the corresponding key until the desired letter displays on the screen. Use the **CAPS** softkey to change the case as needed.

To edit during entry, delete the character to the left of the cursor by pressing the **Del** softkey. To replace an entry, delete it by pressing the

Clr softkey and then enter the new data. To edit an existing entry, use **Nav◄** and **Nav►** to move the cursor position, and then press the **Del** softkey to delete the character to the left. Insert new data by pressing the buttons on the keypad.

Alphanumeric entries:

Key	caps	CAPS
1	1	1
2	2 a b c	2 A B C
3	3 d e f	3 D E F
4	4 g h I	4 G H I
5	5 j k l	5 J K L
6	6 m n o	6 M N O
7	7 p q r s	7 P Q R S
8	8 t u v	8 T U V
9	9 w x y z	9 W X Y Z
0	0	0
*****	* - _ . ! $ % & ’ ( ) + , : ; / \ = @ ~	
#	<space>	

Admin menu

The following table lists the Admin menu items. The default settings have an * prior to the option. Detailed descriptions of each item appear below the table.

Admin Menu

1st level	2nd level	3rd level	4th level	5th level
Phone Config				
	Telephony Protocol	*Type 030		
	Push-to-talk	PTT Enable/*Disable		
		Allowed Channels	*Channel 1 *Channel 2 *…. *Channel 24	
		Name Channels	[list]	Enter Name
		Priority Channel	Priority Channel On/*Off	
			Name Channel	[Enter Name]
	Time Zone	[list] *GMT		
	Daylight Savings	*DST No Adjust DST Auto (USA) DST Auto (AUS) DST Auto (EURO)		
	Protected Spd Dial	Enter Number	Enter Name	Assign Speed-dial
	Password *Enable/Disable			
	[If Password is enabled] Change Password			
	Speakerphone Disable/*Enable			
	Location Service	Enable RTLS *Disable RTLS		
		Transmit Interval	1 minute 5 minutes *10 minutes	
		Location Server IP	Enter IP	
		ELP Port	Enter Port *8552	

1st level	2nd level	3rd level	4th level	5th level
Network Config				
	IP Address	*Use DHCP		
		Static IP	Phone IP Default Gateway Subnet Mask TFTP Server IP Syslog Server IP Time Server IP	
	SS ID	[enter]		
	Security	*None		
		WEP	Authentication	*Open System Shared Key
			WEP Enable/*Disable	
			Key Information	Default Key Key Length Key 1-4
			Rotation Secret	
		WPA2-PSK	Passphrase *Pre-Shared Key	
		WPA-PSK	Passphrase *Pre-Shared Key	
		Cisco FSR	Username Password	

1st level	2nd level	3rd level	4th level	5th level
	Reg. Domain	01 02 03 04 05 06 07		
		→	[802.11 Config]	
			a →	[802.11a]
				5.150–5.250
				5.250–5.350 DFS
				5.470–5.725 DFS
				5.470-5.650 DFS
				5.725–5.825
				5.725-5.850
			*b & b/g mixed g only	
			→	[Transmit Power]
				5mW (7dBm)
				10mW (10dBm)
				20mW (13dBm)
				*30mW (15dBm)
				40mW (16dBm)
				50mW (17dBm)
				100mW (20dBm)
Diagnostics	Run Site Survey			
	Diagnostics Enable/*Disable			
	Syslog Mode	*Disabled Errors Events Full		
	Error Handling Mode Halt on Error *Restart on Error			
Restore Defaults				

* default setting

Phone Config

Telephony Protocol

Telephony Protocol lets you select the VoIP protocol that your site is licensed to download and run. The SpectraLink Radio Protocol (SRP) used for the SpectraLink 8020/8030 Wireless Telephones in a SpectraLink 8000 Telephony Gateway system requires Telephony Protocol type **030**. Any other protocol will cause the handset to malfunction.

Push-to-talk

PTT is disabled by default. When enabled, all 24 PTT channels are allowed by default. To toggle the allowed status of any channel, select **Enable Channels**, scroll to the channel to be disallowed and press **NavOK**. Enabled channels are displayed with an asterisk (*) in the left column. Only those channels enabled in the Admin menu will appear on the **Config menu** where they can be subscribed to by the end user. The priority channel, labeled by default as channel 25, may be set and will be available to all PTT handsets. When a PTT broadcast is made on the priority channel, it will override any active PTT transmission on all other channels.

Time Zone

Worldwide time zone options are available. Greenwich Mean Time (GMT) is the default.

Daylight Savings

The handset may be adjusted for daylight savings time.

Protected Speed-dial

The protected speed-dial number is designed to be programmed to a number that should be called in emergency situations. It appears as the first item on the speed-dial list and is specially marked with a greater-than symbol (>) as the first character in its name. Only one such number can be programmed Enter the number to be dialed, the name (e.g. **Security**), and scroll to assign to one key press. The choices

for this key press are 1-9, 0, *, #, or ^. The carat represents the volume up and down buttons. This number must be programmed in every handset. This setting cannot be modified by the user. This feature is not available in a handset where the user has disabled **Pre-dial** in the **Config menu**.

Password Enable/Disable/Change

The password option controls access to the Admin menu. It is enabled by default with the password 123456. The **Password** option operates as a toggle between **Enabled** and **Disabled**. The info line will display the current state. Press **NavOK** to change the password protection state. To modify the password requirement, the default or previously set password must be entered to verify the change. **Change Password** will appear only if the password is enabled. The password is disabled by default. The password must be set in each handset for which controlled access is desired.

Speakerphone Enable/Disable

The speakerphone may be disabled when quiet handset operation is required. The current speakerphone setting is shown on the info line. Press **NavOK** to toggle to the alternate setting.

The speakerphone option must be programmed in the SpectraLink 8000 Telephony Gateway for it to function as an off-hook softkey option. See *SpectraLink 8000 Telephony Gateway: Administration Guide* for more information.

If the speakerphone is disabled in the Admin menu, the **Spkr** softkey will not appear during standby. However, if it has been programmed in the SpectraLink 8000 Telephony Gateway, the **Spkr** softkey will appear during active mode but it will be non-functional.

Location Service

Location service may be used to enable or disable the Ekahau Real-Time Location System (RTLS), select a transmit interval, or enter a static IP address for the Ekahau Positioning Engine (EPE). Location services capability is provided by the EPE 4.0 using Ekahau Location Protocol (ELP). See Ekahau's user documentation for more information.

RTLS [Enable/Disable] The RTLS is disabled by default. Press **NavOK** to toggle to the alternate setting. When RTLS is enabled, the handset will display the RTLS icon in the top center of the screen.

The ring indicator icon will take precedence over the RTLS icon, i.e. the new icon will not be visible while the handset is ringing. When ringing has ceased and the ring indicator becomes inactive, the RTLS icon will again appear (regardless of hook state).

Transmit interval Allows selection of **1 minute**, **5 minutes**, or **10 minutes** for maximum time between transmit intervals. Default transmit interval is 10 minutes. Press **NavOK** to select the desired transmit interval.

To optimize battery life, the interval between sending out ELP updates will vary based on handset state. It is expected that ELP updates will occur at most every two to six seconds and at least every few minutes. If improved tracking capability is desired, set the transmit interval for a shorter time between ELP updates. Increasing the frequency of transmissions will decrease battery life.

Location Server IP Allows the user to statically enter the IP address of the EPE. Enter the IP address and press **NavOK** to save.

Ekahau clients are not expected to find the EPE automatically. Regardless of the handset's selection of DHCP or static IP, the EPE IP address must be statically entered in the Ekahau admin menus or HAT.

ELP Port Allows the user to select the port number which ELP updates get sent to at the Location Server IP address. It must match the value configured in the Ekahau Positioning Engine for proper functionality. The ELP port number must be greater than zero and less than 65536. Default is 8552. Enter the port number and press **NavOK** to save.

Network Config

IP Address

There are two modes in which the handset can operate: DHCP enabled or Static IP. Select the mode for operation from the IP address menu:

*** Use DHCP** Will use DHCP to assign an IP address each time the handset is turned on. If DHCP is enabled, the handset also receives all other IP address configurations from the DHCP server.

Static IP Allows you to manually set a fixed IP address. If selected, the handset will prompt for the IP addresses for each configurable network component. When entering addresses, enter the digits only, including leading zeroes. Do not enter punctuation.

Regardless of the mode in which the handset is operating, the following components must be configured:

Phone IP The IP address of the handset. This is automatically assigned if DHCP is used. If using Static IP configuration, you must obtain a unique IP address for each handset from your network administrator.

Default Gateway and Subnet Mask Used to identify subnets, when using a complex network which includes routers. Both of these must be configured either with an IP address under Static IP (not set to 000.000.000.000 or 255.255.255.255) or with DHCP for the handset to contact any network components on a different subnet. If configured on the DHCP server, use option 3 for the Default Gateway and option 1 for the Subnet Mask. Contact your network administrator for the proper settings for your network.

SpectraLink 8020/8030 Wireless Telephones cannot roam with uninterrupted service between subnets unless specific LAN components are present. Certain AP/Ethernet switch combinations establish a layer-2 tunnel across subnets that enables the handsets to roam. Without this capability, any call in progress will be dropped when the user moves out of range and the handset must be power cycled in order to resume functionality in the new subnet area.

Ensure that all your APs are attached to the same subnet for proper operation. The handset can change subnets if DHCP is enabled and the handset is powered off then back on when within range of APs on the new subnet.

Please see *Deploying Enterprise-Grade Wi-Fi Telephony: Best Practices* for detailed configuration information.

TFTP Server IP The IP address of a TFTP server on your network which holds software images for updating the wireless telephones. If this feature is configured (not set to 0.0.0.0 or 255.255.255.255) either via Static IP configuration or using DHCP option 66 (TFTP server), or the Boot server/next server (siaddr) field, the wireless telephone will check for newer software each time it is powered on or comes back into range of your network. This check takes only a second and ensures that all wireless telephones in your network are kept up-to-date with the same version of software.

Syslog Server IP The IP address of the syslog server. See Chapter 5 *Diagnostic Tools* for more information.

Time Server IP The IP address of the time server. The time server controls the date/time information that is displayed in standby mode.

SSID

Enter the SSID.

Security

***NONE** Disables any 802.11 encryption or security authentication mechanisms.

For WEP, WPA-PSK and WPA2-PSK set each of the following options to match exactly the settings in your APs.

Encryption codes display as they are entered. For security reasons, codes will not display when a user returns to encryption options in the Admin menu.

WEP (Wired Equivalent Privacy) A wireless encryption protocol that encrypts data frames on the wireless medium allowing for greater security in the wireless network. If WEP is required at this site, you must configure each handset to correspond with the encryption protocol set up in the access points. Select the entries from the options below to enable the handset to acquire the system.

Authentication
Select either **Open System** or **Shared Key**.

WEP Enable/Disable
Select either **Enable WEP** or **Disable WEP**.

Key Information

Default Key Enter the key # specified for use by the handsets. This will be 1 through 4.

Key Length Select either **40-bit** or **128-bit**, depending on the key length specified for use at this location.

Key 1-4 Scroll to the key option that corresponds to the **Default Key** that was entered above. Enter the encryption key as a sequence of hexadecimal characters. (Use the **2** and **3** keys to access hexadecimal digits **A** through **F.**

Rotation Secret This is used for proprietary WEP key rotation. Refer to your custom document if this feature is supported in your system.

WPA2-PSK The security features of WPA2 using PSK are available and may be used if supported by the access points in the facility. Select either **Passphrase** and enter a passphrase between 8 and 63 characters in length or **Pre-Shared Key** and enter the 256-bit key code.

WPA-PSK The security features of WPA (Wi-Fi Protected Access) using PSK (pre-shared key) are available and may be used if supported by the access points in the facility. Select either **Passphrase** and enter a passphrase between 8 and 63 characters in length or **Pre-Shared Key** and enter the 256-bit key code.

Consult the *Configuration Note* for the APs installed in your facility for information on which of the WPA versions are recommended by Polycom. Configure the recommended version on the AP and select the corresponding option on the Admin menu.

Cisco FSR (Fast Secure Roaming) In order to provide the highest level of security without compromising voice quality on Cisco Aironet wireless LAN APs, Polycom and Cisco Systems have cooperated to implement the Fast Secure Roaming mechanism. FSR is designed to minimize call interruptions for SpectraLink 8000 System handset users as they roam throughout a facility. Existing Aironet 350, 1100 and 1200 APs may require a firmware upgrade to support FSR. Cisco FSR requires advanced configuration of the Cisco APs in your site. See your Cisco representative for detailed documentation on configuring your APs and other required security services on your wired network. To configure Cisco FSR in your SpectraLink 8020/8030 Wireless Telephone, you must enter a RADIUS server username and password into each handset.

Username Enter a username that matches an entry on your RADIUS server Usernames are alphanumeric strings and can be entered using the alphanumeric string entry technique.

Password Enter the password that corresponds to this username.

Regulatory Domain/802.11 Config/Transmit Power

Regulatory domain, 802.11 configuration and transmit power are interdependent. See *Appendix A: Regulatory Domains* for regulatory domain setting specifications. Polycom recommends that you check with local authorities for the latest status of national regulations for both 2.4 and 5 GHz wireless LANs.

FCC requirements dictate that the menu for changing the regulatory domain be available by password, which in our case is the **LINE** key.

Press **LINE** and then navigate to the desired domain. Press **NavOK** to set the domain.

01 - North America

02 – Europe

03 – Japan

04 – Singapore

05 – Korea

06 – Taiwan

07 – Hong Kong

802.11 config

Once the regulatory domain is set, the **802.11 Config** modes are displayed. Only one may be chosen. **802.11(b & b/g mixed)** is the default. Press **NavOK** to set the mode. If the mode has subbands, the **Subband** list will open. If the mode does not have subbands, the **Transmit Power** list will open.

Use **g only** if all of your infrastructure devices use only 802.11g. The handsets will operate up to 54 mb/s in this mode.

Use **b & b/g mixed** if some of your infrastructure components only understand 802.11b. The handsets will operate up to 11 mb/s.

Subbands have not been established for the **b and b/g mixed** or the **g only** mode at this writing. Provision is made in the software to accommodate these ranges once established. Newly added subbands may not appear in the above table.

Subband

Once a mode is set the subband list will display, if applicable. Only those ranges which are allowed in the set regulatory domain and that pertain to the set mode are displayed. Note that for 802.11a the bands labeled **DFS** will vary depending on the set regulatory domain. Multiple subbands may be set. Navigate to the desired subband and set with **NavOK.** The **Transmit Power** menu will open. Once the **Transmit Power** setting is done, you will be returned to the subband list.

To deselect a subband, navigate to it and press **NavOK**.

Once the subband settings are as desired, press the **Done** softkey to exit to the **Network Setup** menu.

Transmit power

For subbands: The **Transmit Power** list opens when **NavOK** is pressed from the **Subband** menu. A transmit power setting is required for each subband. Only one level may be set per subband. Only those power levels which apply to the regulatory domain and 802.11 mode are listed. Navigate to the desired level and press **NavOK** to set and return to the subband list. Another subband may be selected which repeats the process.

If the highlighted power transmit level is legal on all of the subbands for the set mode, an **All** softkey will appear. Press the **All** softkey to apply that level to all subbands and return to the subband menu where all subbands will now be selected. **All** overrides any previously set power transmit levels.

Without subbands: When the 802.11 mode has no subbands, the **Transmit Power** list opens when **NavOK** is pressed to set the mode. Only those power levels which apply to the domain and 802.11 mode are listed. Navigate to the desired level and press **NavOK**. This sets the transmit power level and exits the **Regulatory Domain** menus. The **Network Setup** menu will again display.

Diagnostics

Run Site Survey

The Site Survey mode is activated by selecting this option. A site survey starts running immediately upon selecting this option. See the *Diagnostic Tools* section for more information about site surveys.

Diagnostics Mode

See Chapter 5, section *Diagnostics Enabled* for a detailed explanation of the **Diagnostics** mode options.

Syslog Mode

See Chapter 5, section *Syslog Mode* for a detailed explanation of the **Syslog** mode options.

Error Handling Mode

The error handling mode determines how the handset will behave when an error occurs. The **Halt on Error** option will cause the handset to stop operating if an error message is received. Unless the error is a fatal one, normal operation may be resumed by power-cycling the handset. The **Restart on Error** option will cause the handset to make every effort to reboot quietly and quickly to standby mode. In either scenario, a call in progress will be lost.

Error detail may be shown on the display, captured by the syslog server and may also be available for downloading with the Handset Administration Tool.

Restore Defaults

The **Restore Defaults** option will set all user and administrative parameters except **Telephony Protocol** to their factory defaults.

Admin Menu Default Table

When the **Restore Defaults** option is selected, administrative parameters will be reset to their factory defaults as shown in the table below. The **Telephony Protocol** setting will not change. User parameters will be reset per the table on page 28.

Menu option	Setting	Sub-option	Sub-sub-option	Default
Phone Config				
	Push-to-Talk			Enabled
		Allowed Channels		[all]
		Name Channels		[none set]
		Priority Channel		Disabled
	Time Zone			GMT
	Daylight Saving			DST No Adjust
	Protected Spd Dial			[none set]
	Password			Enabled
	Change Password			[n/a]
	Speakerphone			Enabled
Network Config	IP Addresses			Use DHCP
	SSID*			[None set]
	Security			None
		WEP	Authentication	Open System
			WEP	Disabled
			Key Information	[none set]
			Rotation Secret	[none set]
		WPA2-PSK		Pre-Shared Key
		WPA-PSK		Pre-Shared Key
		Cisco FSR	Username	[none set]
			Password	
	Reg. Domain*			[none set]
		802.11 mode		b & b/g mixed
			Transmit Power	30mW (15 dBm)
Diagnostics	Run Site Survey			[n/a]

Menu option	Setting	Sub-option	Sub-sub-option	Default
	Diagnostics			Disabled
	Syslog Mode			Disabled
	[Error Handling Mode]			Restart on Error
Restore Defaults				

*Minimum requirements for functionality after Restore Defaults:
Set SSID to an available AP, set Regulatory Domain to 01.

User-defined Preferences

The SpectraLink 8020/8030 Wireless Telephone features a configuration menu ("**Config menu**") that is available to the user to configure user preferences and display handset information. The **Config menu** is opened by pressing the **Cfg** softkey from standby mode. See the *SpectraLink 8020/8030 Wireless Telephone and Accessories User Guide*.

Config menu	2nd level	3rd level	4th level	5th level	6th level
Lock Keys					
User Profiles	Silent Vibrate Loud Soft Custom				
		Set as Active			
		Ring Settings	Telephone Message Alert 1 Message Alert 2		
				Ring Cadence	Off PBX Continuous Short Pulse Long Pulse
				Ring Tone	Tones 1-10
				Ring Volume	Volume ■■■■■■■■
				Vibrate Cadence	Off PBX Continuous Short Pulse Long Pulse

Config menu	2nd level	3rd level	4th level	5th level	6th level
				Ring Delay	No Delay 5 Second Delay 10 Second Delay
		Noise Mode[1]	Normal High Severe		
		Ring in Headset Ring in Speaker			
		Warning Tones On/Off			
		Key Tones Disable/Enable			
		PTT Disable/Enable			
Phone Settings	Extension Info	Extension Number Extension Name			
	Keypad Autolock	Disable 5 seconds 10 seconds 20 seconds			
	Display Contrast	Set Contrast			
	Use Hearing Aid Use No Hearing Aid				
	Startup Song Play/Inhibit				
	Predial Disable/Enable				

[1] High and Severe noise modes increase microphone, speaker, and ring volume settings above Normal mode baseline. All measures are approximate.

	Microphone	In-ear speaker	Ring volume
High	+12dB	+6dB	+3dB
Severe	+18dB	+12dB	+6dB

Config menu	2nd level	3rd level	4th level	5th level	6th level
Push-to-talk	Default Channel	Channel 1 .... Channel 24			
	Subscribed Channels	Channel 1 Channel 2 Channel 3 Channel 4 .... Channel 24			
	PTT Audio Volume	Audio Volume ■■■■■■■■			
	PTT Tone Volume	Tone Volume ■■■■■■■■			
System Info	Phone IP Address				
	Gateway IP Address				
	Firmware Version				

Default Settings

The profile options on the standby menu may be reset to their default values by the **Restore Defaults** option in the Admin menu. These are the default settings:

Setting/profile	Silent	Vibrate	Soft	Loud	Custom
Ring Cadence	Off	Off	PBX	PBX	PBX
Ring Tone	Tone 1	Tone 1	Tone 1	Tone 1	Tone 1
Ring Volume	1	1	3	7	5
Vibrate Cadence	Off	PBX	Off	Off	PBX
Ring Delay	0	0	0	0	5
Noise Mode	Normal	Normal	Normal	Normal	Normal
Headset/Speaker	Speaker	Speaker	Speaker	Speaker	Speaker
Key Tones	Off	Off	On	On	On
Warning Tones	Off	Off	On	On	On
Push-to-talk	Off	Off	On	On	On

3

Software License and Protocol Management

The SpectraLink 8000 System supports a number of different IP protocol integrations. All SpectraLink 8020/8030 Wireless Telephones are shipped from Polycom with a generic software load that allows them to associate to a wireless LAN and download their functional software from a TFTP server. **The handsets may not function properly without downloading appropriate software.**

The following details the process to properly configure handsets and download software via over-the-air file transfer.

Requirements

- A wireless LAN must be properly configured and operational through the use of 802.11a/b/g wireless APs.
- The SpectraLink 8000 Telephony Gateway must also be connected to your network and completely operational, and the handset must be registered to it.
- A TFTP server is required in the network to distribute software to the handsets.
- Software versions required:

Component	Version
SpectraLink 8000 Telephony Gateway	108 or higher
SpectraLink 8000 SVP Server	17x.028 or higher
OAI Server MOG 600	54.032 or higher
OAI Server MOG 700	82.017 or higher

- Finally, ensure that the Battery Pack on the handset is fully charged.

Configuration Process

1. Download the latest SpectraLink 8020/8030 Wireless Telephone software from http://www.spectralink.com/softwareUpdates
2. Place the latest version of the SpectraLink 8020 or 8030 Wireless Telephone SRP code on the TFTP server and ensure the TFTP server is started. The five files that are needed must be named:

usb downloader	pd14udsp.bin
functional filename	pd14csp.bin
phintl filename	pi1400sp.bin
ota downloader	pd14odsp.bin
config file	slnk_cfg.cfg

3. See *SpectraLink 8000 Telephony Gateway: Administration Guide* to set the TFTP server information.
4. Use the Handset Administration Tool to set up the configuration of each handset to meet all essential requirements. If not using the Handset Administration Tool, ensure the following parameters are correctly set in the Admin menu for each handset: See Chapter 2 *SpectraLink 8020/8030 Wireless Telephone Configuration* for detailed configuration instructions.
   - If statically assigning IP addresses, ensure that the **Phone IP**, **Subnet Mask**, and **Default Gateway** information are accurate. If using a DHCP Server, ensure that the DHCP option is set.
   - Ensure the handset has properly configured **SSID** and **Reg Domain** information.
   - Ensure the **Telephony Protocol** menu option is set to **030**. This ensures the handset will check for the proper SRP files each time it powers on.
   - Ensure security settings are properly programmed.
5. Power cycle the handset.
6. The SRP code will now download to the handset. The status bar will increment fully across the display for each function that is being performed in the download process and the filename will display. Upon completion of the update process, the handset will re-boot with the new firmware.

For future software upgrades, simply update the files that are stored on the TFTP server. Each time the handset is powered up, it will check with the TFTP server to ensure it has the same software version and download the code on the TFTP server if it does not match the code on the handset..

4

Testing the Handsets

Verify proper registration and operation of each handset by performing the following tests on the handset in an active wireless area.

1. Power on the handset by pressing **END**. You will see a series of messages displayed as the handset acquires the system. The handset should display the user extension or dashes if no extension is programmed. Any error messages should clear.
2. Press the **START** key. The extension number should clear and you should hear dial tone. On some digital systems, depending on how the telephone system is programmed, you may have to select a line to get dial tone. Place a call and listen to the audio quality. End the call by pressing the **END** key.
3. Place a call to the handset and verify ring, answer, clear transmit and clear receive audio.
4. Use the softkeys to verify all softkey programmed features on the handset.
5. Press the **END** key. Any line indicators should turn off and the extension number display will return.

If any of these steps fails to operate as described, refer to Chapter 8 *Troubleshooting* for corrective action.

5

Diagnostic Tools

Run Site Survey, **Diagnostics Enabled** and **Syslog Mode** are three diagnostic tools provided to assist the wireless LAN administrator in evaluating the functioning of the SpectraLink 8020/8030 handset and the system surrounding it. Diagnostic Tools are enabled in the Admin menu.

Run Site Survey

Site survey is used to evaluate the facility coverage before certifying that an installation is complete. It can also be used at any time to evaluate coverage by testing signal strength, to gain information about an AP, and to scan an area to look for all APs regardless of SSID. The information available through the site survey includes:

- SSID
- Beacon Interval
- Information regarding support of 802.11d, 802.11g, 802.11h and other 802.11 amendment standards as required
- Current security configuration

Start the site survey by selecting **Run Site Survey** from the Admin menu. The mode starts immediately.

When the test is started, it is by default in "single SSID" mode. When the **Any** soft key is pressed (softkey A) all APs, regardless of SSID, are displayed and the softkey changes to say **MyID**. Pressing the **MyID** soft key will revert to the "single SSID" mode and change the softkey back to **Any**.

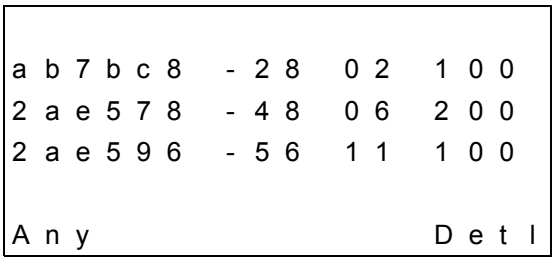
The display would look like the following for the multiple AP mode.

```
1 1 1 1 1 1   - 2 2   3 3   4 4 4
1 1 1 1 1 1   - 2 2   3 3   4 4 4
1 1 1 1 1 1   - 2 2   3 3   4 4 4
1 1 1 1 1 1   - 2 2   3 3   4 4 4
A n y                       D e t l
```

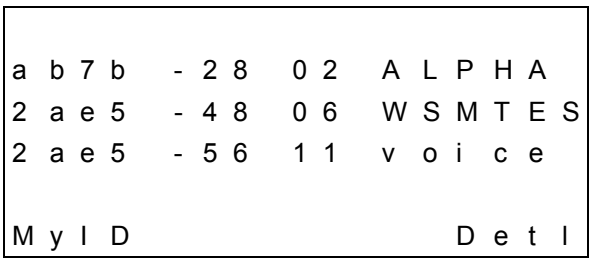
Where:

- 111111 – the last three octets of the on-air MAC address for a discovered AP.
- 22 – the signal strength for the specified AP.
- 33 – the channel number of the specified AP.
- 444 – the beacon interval configured on the specified AP.
- Any/MyID – softkey to toggle between "single SSID" and "any SSID" mode.
- Detl/Smry – softkey to toggle between the multiple AP (summary) display, and the single (detail) displays for each AP.

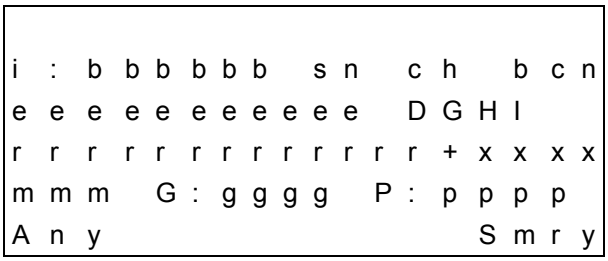
The following screen shows how the display would look when there are three APs configured with an SSID that matches that of the handset. The first has a signal strength of –28 dBm, is configured on channel 2, with a beacon interval of 100 ms. The second has a signal strength of –48 dBm, is configured on channel 6, with a beacon interval of 200 ms. The third has a signal strength of –56 dBm, is configured on channel 11 with a beacon interval of 100 ms.



When the **Any** SSID mode is selected, the summary display contains the first six characters of the APs SSID instead of the beacon interval as in the example below.



In detail mode the display would appear as follows. The left/right arrow keys will move between AP indices.



Where:

- i – index of selected AP (value will be from 0 to 3 inclusive)
- bbbbbb – the last three octets of the BSSID for a discovered AP
- sn – signal strength in –dBm
- ch – channel
- bcn – beacon interval
- eeeeeeeeeee – SSID (up to first 11 characters)
- DGHI – standards supported
- rrrrrrrr – rates supported. Basic rates will have a "b" following the rate
- + – more rates are supported than those displayed
- xxxx – WMM or UPSD if those QoS methods are supported
- mmm – security mode
- G:gggg – group key security
- P:pppp – pairwise key security
- Any/MyID – softkey to toggle between "single SSID" and "any SSID" modes
- Detl/Smry – softkey to toggle between the multiple AP display (summary), and the single AP display (detail)

Numbers racing across the handset display indicate AP information is being obtained. A **Waiting** message indicates the system is not configured properly and the handset cannot find any APs.

Solving coverage issues

Coverage issues are best resolved by adding and/or relocating APs.

Overlap issues may be resolved by reassigning channels to the APs or by relocating them. See the *Troubleshooting* chapter, section on *Access Point Problems* for more information.

Diagnostics Enabled

Diagnostics is used to evaluate the overall quality of the link between the handset, AP, and infrastructure side equipment, such as IP PBX, SpectraLink 8000 SVP Server, and gateways. Unlike **Site Survey**, **Diagnostics** is used while the functional code is running, and during a call.

When **Diagnostics** is enabled in the Admin menu, the handset can display diagnostic screens any time it is in active mode.

The display of information is instigated by pressing the **Nav**◄ or **Nav**► key. Only four of the diagnostic counters listed below can be shown at a time. Pressing the **Nav** keys multiple times will cycle through the various counters and the normal off-hook (IP-PBX) display. The numeric icon at the top of the display indicates what screen number is being displayed. For example: The first time the **Nav** key is pressed, the **1** icon is shown, and the first four counters are displayed. The next time it is pressed, the **2** icon is shown, and the next four counters are displayed. The counters will be cycled through in this fashion until there are no more counters to be displayed. After all the counters have been displayed, the screen returns to the normal off-hook IP-PBX screen.

The information provided by **Diagnostics** includes:

Screen 1

- Missed receive packet count since power up (MissedRcvCnt)
- Missed transmit packet count since power up (MissedXmtCnt)
- Receive retry count since power up (RxRetryCount)
- Transmit retry count since power up (TxRetryCount)

```
MissedRcvCnt    nnnnn
MissedXmtCnt    nnnnn
RxRetryCount    nnnnn
TxRetryCount    nnnnn
```

Screen 2

- Jitter – average error or "wobble" in received packet timing, in microseconds
- Last successful transmit data rate (LastRate)
- Gateway type (GatewyType)

```
Jitter          nnnn
LastRate        nnnn
GatewyType      mnemo
```

Where:

mnemo – a mnemonic that indicates what type of gateway is being used

- 11Mb – this system can run at full speed

Screen 3

Screen 3 contains a list of the APs that are heard and the following parameters from each AP:

- Indicator as to whether this is the current AP or an index into the list of other APs heard (C indicates current)
- Last 2 octets of the MAC address of the AP (mmmm)
- Channel number (ch)
- Signal strength (ss)
- Either the 802.11 Association ID from the current AP or a mnemonic for the reason code indicating why the handset didn't hand off to this other AP

```
C : m m m m   c h   - s s   a i d
1 : m m m m   c h   - s s   m n e m
2 : m m m m   c h   - s s   m n e m
3 : m m m m   c h   - s s   m n e m
```

Where:

AP mnem – a mnemonic indicating the reason code:

- Unkn – reason unknown
- Weak – signal strength too weak
- Rate – one or more basic rates not supported
- Full – AP can not handle bandwidth requirements
- AthT – authentication timeout
- AscT – association timeout
- AthF – authentication failure
- AscF – association failure
- SecT – security handshake timeout
- SecF – security handshake failure
- Cnfg – AP not configured correctly for security, QoS mode or infrastructure network

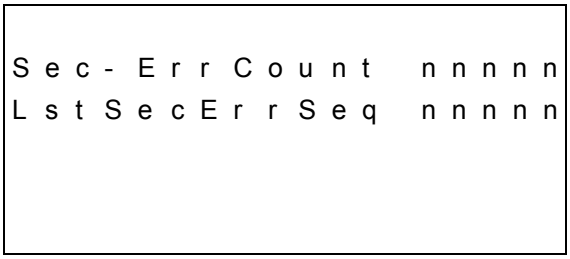
Screen 4

- Association count since power up (AssocCount)
- Re-association count since power up (ReAssocCount)
- Association failures since power up (AssocFailure)
- Re-association failures since power up (ReAssocFail)

```
A s s o c C o u n t        n n n n n
R e A s s o c C o u n t    n n n n n
A s s o c F a i l u r e    n n n n n
R e A s s o c F a i l      n n n n n
```

Screen 5

- Security error count since power up (Sec-ErrCount)
- MAC sequence number of frame with last security error (LstSecErrSeq)



Syslog Mode

A syslog server must be present on the network in order for the handset to send the log messages and have them saved. The syslog server will be found with DHCP option 7 if the handset is using DHCP. If static addresses are configured, the syslog server's IP address can be configured statically in the Admin menu.

If the syslog server address is blank (000.000.000.000 or 255.255.255.255) or the handset is using DHCP and no option 7 is received from the DHCP server, the handset will not send any syslog messages.

Admin menu options:

- ***Disabled** – turns syslog off.
- **Errors** – causes the handset to log only events that we consider to be an error (see below).
- **Events** – logs all errors plus some other interesting events (see below).
- **Full** – logs all the above plus a running stream of other quality information (see below).

The table below lists the syslog messages and which level of logging will produce them:

Message type	Errors	Events	Full
Failed Handoff	Yes	Yes	Yes
Successful Handoff	No	Yes	Yes
Security Error	Yes	Yes	Yes
Call Start/End	No	Yes	Yes
Audio stats	No	No	Yes (every 5 secs)
Audio error threshold exceeded	Yes	Yes	Yes
Radio stats	No	No	Yes (every 5 secs)
Radio error threshold exceeded	Yes	Yes	Yes
Error Handling Mode	Yes	Yes	Yes

All syslog messages will include:

- Date and time (to 1/100th of second) since handset power on (The handset time is set when it is powered on to Jan-1 00:00.00 GMT adjusted. If it has obtained a time from the network time server, that time will display instead.)
- Handset's MAC address
- Handset's IP address
- Sequence number

The table below lists the additional items in each message type:

Message Type	Additional Syslog Message Items
Failed Handoff (Sent whenever the handset attempted to handoff, but failed trying.)	Failed AP MAC Failed AP signal strength Current AP MAC Current AP signal strength Failure reason
Successful Handoff	New AP MAC New AP signal strength Old AP MAC Old AP signal strength Reason for handoff Other candidate APs: MAC Signal strength Reason not used
Security Error	AP MAC AP signal strength Security mode Error details (mode-dependent)
Call Start	Call type (telephony, OAI, PTT) AP MAC AP signal strength
Call End	AP MAC AP signal strength

Audio stats	AP MAC AP signal strength Payload size (in msec) Payloads sent Payloads received Payloads missed (not received) Payloads missed rate (over last 5 seconds) Payloads late Payloads late rate (over last 5 seconds) Average jitter
Audio error threshold exceeded (Sent if payloads missed rate or payloads late rate exceeds 2%, or if the average jitter is over 2 msec)	Same as audio stats
Radio stats	AP MAC AP signal strength Directed packets sent Directed packets received Multicast packets sent Multicast packets received Broadcast packets sent Broadcast packets received TX dropped count TX drop rate (over last 5 seconds) TX retry count TX retry rate (over last 5 seconds) RX retry count RX retry rate (over last 5 seconds)
Radio error threshold exceeded (Sent if TX drop rate exceeds 2% or TX or RX retry rate exceeds 5%)	Same as radio stats

<table>
<tr>
<td>Download failure</td>
<td>Download aborted, code incompatible. 0x1234
The hex value indicates which types of files failed per following list:
<table>
<tr><th>File type</th><th>Bit value</th><th>Hex Value</th></tr>
<tr><td>FILE_TYPE_UNKNOWN</td><td>00000001</td><td>0x1</td></tr>
<tr><td>FILE_TYPE_CFG</td><td>00000010</td><td>0x2</td></tr>
<tr><td>FILE_TYPE_USBDL</td><td>00000100</td><td>0x4</td></tr>
<tr><td>FILE_TYPE_OTADL</td><td>00001000</td><td>0x8</td></tr>
<tr><td>FILE_TYPE_FUNC</td><td>00010000</td><td>0x10</td></tr>
<tr><td>FILE_TYPE_SUPP (phintl or other supplemental files)</td><td>00100000</td><td>0x20</td></tr>
</table>
The failures are bitwise or together so for example, if cfg and USBDL both fail, then the output would be 0x2 | 0x4 which would be 0x6.</td>
</tr>
</table>

Messages are formatted like the following example:

Jan 1 00:01:26.72 0090.7a02.2a1b (172.16.0.46) [001a] RStat: AP 00:40:96:48:1D:0C (-56 dBm), Sent 783523, Recvd 791342, MSnt 245, MRcd 5674, BSnt 43, BRcd 10783, TX drop 43 (0.0%), TX retry 578 (1.2%), RX retry 1217 (1.6%)

6

Certifying the Handsets

Prior to determining that an installation is complete, test the handsets following the sequence given in Chapter 4 *Testing the Handsets* and conduct a site survey mode test according to the directions given in Chapter 5 *Diagnostic Tools*.

The installation may need some adjustments. Note any areas where coverage is conflicting or inadequate. Note any system difficulties and work with your wireless LAN and/or LAN system administrator to determine the cause and possible remedy. See Chapter 8 *Troubleshooting* for clues to possible sources of difficulties. If any adjustments are made to the system, re-test the device in the same vicinity to determine if the difficulty is resolved.

These tests must be performed in typical operating conditions, especially if heavy loads occur. Testing sequence and procedure is different for every installation. Generally, you should organize the test according to area and volume, placing numerous calls to others who can listen while you perform coverage tests. Note any areas with excessive static or clarity problems and report it to a Polycom service engineer.

The coverage test will also require you to put the handset in **Site Survey** mode and walk the entire coverage area to verify all APs.

Conducting a Site Survey

Conduct a site survey of the installation by walking the site looking for interfering 802.11 systems, adequate coverage and channel assignment and correct AP configuration.

1. Referring to Chapter 5, section *Run Site Survey*, put a handset into site survey in the **Any** SSID mode, **Smry** display. Walk throughout the site checking for any expected APs or other SSIDs.
2. Then walk the site again in **MyID** SSID mode, **Smry** display. This time check that every location has adequate coverage (there should be at one AP stronger than -70dBm in all areas) and has

good channel allocation (at any point, the strongest AP shown should be on a different channel than the next best choice).

3. Finally, use the single AP (**MyID**) and **Detl** display to check each AP to ensure it is configured for the proper data rates, beacon interval, 802.11 options enabled, QoS method and security method.

Make any necessary adjustments to AP locations and configurations and repeat steps 1 through 3 until the site survey shows adequate coverage and correct configuration at every location.

The installation is not complete until these certification steps have been performed. Do not hand out wireless telephones at a site that has not been certified.

7

Software Maintenance

The SpectraLink 8020/8030 Wireless Telephones use proprietary software programs written and maintained by Polycom Corporation. The software versions that are running on the handsets can be displayed during power on by holding down the **END** button. **Firmware Version** is also an option on the **Config menu**.

Polycom Customer Service or an authorized dealer will provide information about software updates and how to obtain the software (for example, downloading updates from a website).

Upgrading Handsets

After software updates are obtained from Polycom, they must be transferred to the network TFTP server. See *SpectraLink 8000 Telephony Gateway: Administration Guide* for an explanation of how to update the SpectraLink 8020/8030 Wireless Telephone software in the network TFTP server so that it can then be downloaded into the handsets.

SpectraLink 8020/8030 Wireless Telephones allow over-the-air transfer of software updates from the network TFTP server to the handsets. The download function in the handset checks its software version every time the handset is turned on. If there is any discrepancy the handset immediately begins to download the update.

Normal Download Messages

When the handset is powered on, it displays a series of messages indicating that it is searching for new software, checking the versions, and downloading. The normal message progression is:

Message	Description
Checking Code	Handset is contacting the TFTP server to determine if it has a newer version of software that should be downloaded.
Erasing Memory	Handset has determined that a download should occur and is erasing the current software from memory. This message also displays a progress bar. When the progress bar fills the display line the erase operation is complete.

Message	Description
Updating Code	Handset is downloading new software into memory. The number icons at the bottom of the display indicate which file number is currently being downloaded. This message also displays a progress bar. When the progress bar fills the display line the update operation is complete on that file.

When the update is complete, the handset displays the extension number and is ready for use.

Download failure or recovery messages

The following display messages indicate a failure or recovery situation during the download process. See Chapter 8 *Troubleshooting* for more information about each message.

Server Busy

TFTP ERROR(x):yy

Erase Failed

Waiting

Internal Errors

8

Troubleshooting

On occasion, you may run into transmission problems due to any number of factors originating from the wireless LAN. SpectraLink 8020/8030 Wireless Telephones can exhibit transmission problems in several ways. They can cease functioning properly, display error messages or display incorrect data. When using and troubleshooting handsets, consider the following problem sources to determine the best method of approaching any specific situation.

Access Point Problems

Most, but not all, handset audio problems have to do with AP range, positioning and capacity. Performing a site survey as described above can isolate the AP causing these types of problems. If the handset itself is suspected, conduct a parallel site survey with a handset that is known to be properly functioning.

In-range/Out-of-range

Service will be disrupted if a user moves outside the area covered by the APs. Service is restored if the user moves back within range. If a call drops because a user moves out–of-range, the handset will recover the call if the user moves back into range within a few seconds.

Capacity

In areas of heavy use, the call capacity of a particular access point may be filled. If this happens, the user will hear three chirps from the handset. The user can wait until another user terminates a call, or move within range of another AP and try the call again. If a user is on a call and moves into an area where capacity is full, the system attempts to find another access point. Due to range limitations, this may be the same as moving out of range.

Transmission obstructions

Prior to system installation, the best location for APs for optimum transmission coverage was determined. However, small pockets of obstruction may still be present or obstructions may be introduced into the facility after system installation. This loss of service can be restored by moving out of the obstructed area or by adding APs.

Configuration Problems

Certain problems are associated with improper configuration of the SpectraLink 8000 Telephony Gateway, the SpectraLink 8020/8030 Wireless Telephone or the SpectraLink 8000 SVP Server.

For instance, no extension displayed or wrong extension displayed on the handset has no effect on its operation but serves to easily identify it. Other configuration problems, like having incorrect menu items, or inability to connect or access telephone system features, affect the handset's functioning.

Configuration problems are generally corrected by changing the configuration at the SpectraLink 8000 Telephony Gateway, the SpectraLink 8000 SVP Server or on the handset. See the *SpectraLink 8000 Telephony Gateway: Administration Guide* document for specific configuration steps. There may also be incorrect programming of the PBX or AP. See the appropriate *LinkPlus Integration Guide* or the *Configuration Note* for the AP in use at the site.

Infrastructure Problems

Calls ringing on the wrong handset or when multiple handsets are not working often indicate faulty installation. The wires that connect the demarcation (demarc) block to the SpectraLink 8000 Telephony Gateway may be installed incorrectly.

Contact your wireless LAN and/or PBX vendor for more information about troubleshooting infrastructure problems.

Dial Tone Problems

A dial tone problem exists if the handset has no dial tone or if the user is unable to hear the other party's voice, hears echo or hears dead air. Dial tone problems can be caused by a number of different situations and should be investigated by following these steps:

1. Power on the handset in an active service area. If the handset does not get a dial tone in an active area, continue with the steps below. If the no dial tone problem is limited to a certain area, see Chapter 8, section *Access Point Problems*.

   Any initialization or error messages should turn off a few seconds after the handset is powered on.

2. Swap the Battery Pack with a Battery Pack from a functional handset, power the handset back on and check for dial tone. If this corrects the problem, try recharging the Battery Pack that was removed.

3. Turn the handset off, then on again, and then test again for dial tone. If functioning, place a call and determine voice quality.

4. While maintaining an active call, walk through several AP areas. If fluctuation occurs see Chapter 8, section *Access Point Problems*.

5. Check for alarms on the SpectraLink 8000 Telephony Gateway or the SpectraLink 8000 SVP Server (via System Status). If there are alarms, see *SpectraLink 8000 Telephony Gateway: Administration Guide* or *SpectraLink 8000 SVP Server: Administration Guide* for information.

6. Make sure the handset's gateway port is connected to a working telephone line. Check the line at the demarc block. You may need to contact your vendor to perform this check.

7. Check the cabling between the gateway and the demarc block and between the demarc block and the telephone system ports.

8. Move the handset to a different port location and test again.

Handset Status Messages

Handset status messages provide information about the SpectraLink 8020/8030 Wireless Telephone's communication with the AP and host telephone system. The following table summarizes the status messages, in alphabetical order.

Message	Description	Action
	Download failure icon	Update handset code in the TFTP server and power cycle the handset.
3 chirps (audio)	Handset is not able to communicate with the best AP, probably because that AP has no bandwidth available.	None. This is only a warning, the call will handoff to the best AP once it becomes available.
Address Mismatch	Handset software download files are incorrect or corrupted.	Download new software from the SpectraLink site per Chapter 7 *Software Maintenance*.
Assoc Failed xxxxxxxxxxxx	x…x = AP MAC address. Handset association was refused by AP; displays MAC of failing AP.	Check handset and AP security settings. Ensure AP is configured per *Configuration Note*. Try another AP.
Assoc Timeout xxxxxxxxxxxx	x…x = AP MAC address. Handset did not receive association response from AP; displays MAC of failing AP.	Check handset and AP security settings. Ensure AP is configured per *Configuration Note*. Try another AP.
Auth Failed xxxxxxxxxxxx	x…x = AP MAC address. Handset authentication was refused by AP; displays MAC of failing AP.	Check handset and AP security settings. Ensure AP is configured per *Configuration Note*. Try another AP.
Auth Timeout xxxxxxxxxxxx	x…x = AP MAC address. Handset did not receive authentication response from AP; displays MAC of failing AP.	Check handset and AP security settings. Ensure AP is configured per *Configuration Note*. Try another AP.
Bad Code Type xx Expected Code Type yy	xx, yy = software license types Handset software does not match current handset license selection.	Download new software from the SpectraLink site per Chapter 7 *Software Maintenance*.
Bad Config	Some needed configuration type has not been set.	Check all required handset configuration parameters for valid settings.
Bad SSID	No SSID has been entered.	Enter an SSID in the Admin menu.

Message	Description	Action
Bad Phintl File	Handset software download files are incorrect or corrupted.	Download new software from the SpectraLink site per Chapter 7 *Software Maintenance*.
Bad Program File	Handset software download files are incorrect or corrupted.	Download new software from the SpectraLink site per Chapter 7 *Software Maintenance*.
(battery icon), Battery Low, beep (audio)	Low battery.	In call: the battery icon displays and a soft beep will be heard when the user is on the handset and the battery charge is low. User has 15–30 minutes of battery life left. The Battery Pack can be changed while the call is still in progress. Do not press the END key. Quickly remove the discharged Battery Pack and replace with a charged Battery Pack, power on the handset and press the START key to resume the call in progress. Not in call: The battery icon displays whenever the Battery Pack charge is low The message Low Battery and a loud beep indicate a critically low battery charge when user is not on the handset. The handset will not work until the Battery Pack is charged.
Battery Failure	The Battery Pack is not functioning.	Replace the Battery Pack with a new or confirmed SpectraLink Battery pack. Any non-SpectraLink Battery Packs will not work.
Battery Failed	Battery Pack is damaged or incompatible with handset.	Replace the Battery Pack with a new or confirmed SpectraLink Battery Pack. Any non-SpectraLink Battery Packs will not work.
Cant Renew DHCP yyy.yyy.yyy.yyy	y…y = DHCP server IP address DHCP server is not responding to initial renewal attempt.	Configuration problem. Check the IP address configuration in the DHCP server.
Charging …	The handset is charging in the Desktop Charger.	No action needed.
Charge Complete	The handset is now fully charged	No action needed.
Checking Code	Handset is contacting the Download Master to determine if it has a newer version of software that should be downloaded.	None, this message should only last for approximately one second. If message remains displayed, power off and contact customer support for a replacement handset.
Checking DHCP IP	The handset is retrieving DHCP information from the DHCP server.	None. This is informational only.

Message	Description	Action
CRC Code Error	The software which has been TFTP downloaded has a bad redundancy code check.	Try the download again - it is possible the software was corrupted during download. If the error repeats, check that the download image on the TFTP server is not corrupted.
Code Mismatch!	The software loaded into the handset is incorrect for this model handset.	Verify the License Management value is correct. Replace the software image on the TFTP server with software that is correct for the handset model.
DHCP Error (1-5)	DHCP Error 1	The handset cannot locate a DHCP server. It will try every four seconds until a server is located.
	DHCP Error 2	The handset has not received a response from the server for a request for an IP address. It will retry until a server is found.
	DHCP Error 3	The server refuses to lease the handset an IP address. It will keep trying.
	DHCP Error 4	The server offered the handset a lease that is too short. The minimum lease time is 10 minutes but Polycom recommends at least one hour minimum lease time. The handset will stop trying. Reconfigure the server and power cycle the handset.
	DHCP Error 5	Failure during WEP Key rotation process (proprietary feature).
DHCP Lease Exp. yyy.yyy.yyy.yyy	y…y = DHCP Server IP address DHCP is not responding to renewal attempts (at least one renewal succeeded).	The handset failed to renew its DHCP lease, either because the DHCP server is not running, or because the configuration has been changed by the administrator. The handset will attempt to negotiate a new lease, which will either work, or change to one of the above DHCP errors (1-4).
DHCP NACK Error yyy.yyy.yyy.yyy	y…y = DHCP server IP address DHCP server explicitly refused renewal.	The DHCP lease currently in use by the handset is no longer valid, which forces the handset to restart. This problem should resolve itself on the restart. If it does not, the problem is in the DHCP server.
DL not on sector	Handset software download files are incorrect or corrupted.	Download new software from the SpectraLink site per Chapter 7 *Software Maintenance*.

Message	Description	Action
DO NOT POWER OFF	The handset is in a critical section of the software update.	None. Do not remove the Battery Pack or attempt to power off the handset while this is displayed. Doing so may require the handset to be returned to Polycom to be recovered.
Duplicate IP	The handset has detected another device with its same IP address.	If using DHCP, check that the DHCP server is properly configured to avoid duplicate addresses. If using Static IP, check that the handset was assigned a unique address.
Erase Failed	Download process failed to erase the memory in the handset. This operation will retry.	Operation will retry but may eventually report the error "int. error: 0F." Power cycle the handset.
Erasing Memory	Handset has determined that a download should occur and is erasing the current software from memory. This message also displays a progress bar. When the progress bar fills the display line the erase operation is complete.	None. When the progress bar fills the display line the erase operation is complete. Do not turn the handset off during this operation.
Error!... [error details]	A fatal software error is detected. All handset operation is halted and any call is lost.	This message appears during Halt on Error mode. An error message displays. Note the message details and power cycle the handset.
Fatal Error Err Code ####	The handset has detected a fault from which it cannot recover.	Record the error code so it can be reported. Turn the handset off then on again. If error persists, try registering a different handset to this telephone port. If error still persists, contact Polycom technical support and report the error.
Files too big	Handset software download files are incorrect or corrupted.	Download new software from the SpectraLink site per Chapter 7 *Software Maintenance*.
Flash config error	Handset internal configuration is corrupt.	Perform "Restore Defaults" operation via admin menu or reprogram with the Handset Administration Tool.
Initializing …	The handset is performing power on initialization.	None. This is informational only.
Multiple GW Reg yyy.yyy.yyy.yyy	y…y = Gateway IP address Handset received responses from multiple gateways; displays IP address of one responding gateway.	Check each SpectraLink 8000 Telephony Gateway for the handset's MAC address on the Telephone Line Configuration screen. Delete any duplicate entries leaving only one entry on the correct Telephone Gateway and port for this handset.

Message	Description	Action
Must Upgrade SW!	Handset software is incompatible with hardware.	Download new software from the SpectraLink site per Chapter 7 *Software Maintenance*.
Net Busy xxxxxxxxxxxx	x…x = AP MAC address Handset cannot obtain sufficient bandwidth to support a call; displays MAC of failing AP.	Try the call again later.
No DHCP Server	Handset is unable to contact the DHCP server.	Check that DNCP is operational and connected to wireless LAN or use Static IP configuration in the handset.
No SSID	Attempted to run site survey application without an SSID set.	Configure an SSID in the Admin menu.
No Func Code	Handset software download files are incorrect or corrupted.	Reconfigure the handset to gain access to the wireless LAN and download new code.
No GW Response yyy.yyy.yyy.yyy	y…y = Gateway IP address Handset has lost contact with the SpectraLink 8000 Telephony Gateway. Handset cannot find a SpectraLink 8000 Telephony Gateway. Handset not registered on SpectraLink 8000 Telephony Gateway.	Verify that the SpectraLink 8000 Telephony Gateway is properly configured.
	SpectraLink 8000 Telephony Gateway is not working No LAN connection at the AP or SpectraLink 8000 Telephony Gateway.	Verify that the SpectraLink 8000 Telephony Gateway is powered on. If so, follow standard SpectraLink 8000 Telephony Gateway troubleshooting procedures. Verify SpectraLink 8000 Telephony Gateway connection to LAN and all APs.
No IP Address	Invalid IP.	Check the IP address of the handset and reconfigure if required.
No Net Access	Cannot authenticate / associate with AP.	Verify the AP configuration. Verify that all the WEP settings in the handset match those in the APs.
No Net Found	This indicates the handset cannot find any access points due to: No radio link. No SSID – Auto-learn not supported (or) Incorrect SSID.	 Verify that the AP is turned on. Verify the SSID of the wireless LAN and enter or Auto-learn it again if required. See *SpectraLink 8020/8030 Wireless Telephone Configuration* section.

Message	Description	Action
	AP does not support appropriate data rates.	Check the AP configuration against *Configuration Note* for AP.
	Out of range.	Try getting closer to an AP. Check to see if other handsets are working within the same range of an AP. If so, check the SSID of this handset.
	Incorrect Security settings.	Verify that all the security settings in the WT match those in the APs.
No Net Found xxxxxxxxxxxx yy	x…x = AP MAC address yy = AP signal strength Handset cannot find a suitable access point; displays MAC and signal strength of "best" non-suitable AP found.	Check AP and handset network settings such as SSID, Security, Reg domain and Tx power. Ensure APs are configured per *Configuration Note*. Try Site Survey mode to determine more specific cause.
No Reg Domain	Regulatory Domain not set.	Configure the Regulatory Domain of the handset.
No PBX	No communication with host telephone system.	Displays before the system has synchronized ports with the host telephone system. Should disappear when the ports are correctly wired and programmed. Make sure the proper PBX switch has been selected within the SpectraLink 8000 Telephony Gateway.
No SW found	A required software component has not been identified.	Check that the correct software has been downloaded and is available.
Server Busy	Handset is attempting to download from a Download Master that is busy downloading other handsets and refusing additional downloads.	None. The handset will automatically retry the download every few seconds.
Service Unavailable. Restarting …	An error has caused the handset to lose the call. It is now making its best effort to restart and return to standby mode.	Occurs during Restart on Error mode. The handset is attempting to register with the PBX and resume normal operation. Error details may be available through the syslog server and by download with the Handset Administration Tool.
Storing Config	Handset is storing changes to handset configuration.	None. Informational only. The handset may display this briefly following a configuration change or software download.
System Busy yyy.yyy.yyy.yyy	y…y = SVP Server/Telephony Gateway IP Address Gateway or SVP server has reached call capacity; displays IP address of Gateway/SVP Server.	All call paths are in use. Try the call again in a few minutes.

Message	Description	Action
System Locked (with Busy Tone)	Gateway is locked.	Try the call again, the system has been locked for maintenance.
TFTP ERROR(x):yy	A failure has occurred during a TFTP software download. (x) = The file number which was being downloaded; yy is an error code describing the particular failure. Possible error codes are: 01 = TFTP server did not find the requested file. 02 = Access violation (reported from TFTP server). 07 = TFTP server reported "No such user" error. 81 = File put into memory did not CRC. FF = Timeout error. TFTP server did not respond within a specified period of time.	Error code 01, 02 or 07 - check the TFTP server configuration. Error code 81, the handset will attempt to download the file again. For other messages, power off the handset, then turn it on again to retry the download. If the error repeats, note it and contact Polycom technical support.
Too many errors	The handset continues to reset and cannot be recovered.	Fatal error. Return handset to Polycom.
Unknown xx:yy:zz	A phrase is missing from the phintl file.	Download new software from the SpectraLink site per Chapter 7 *Software Maintenance*.
Updating …	The handset is internally updating its software images	None. The handset may do this briefly after a download. This is informational only.
Updating Code	Handset is downloading new software into memory. The number icons at the bottom of the display indicate which file number is currently being downloaded. This message also displays a progress bar. When the progress bar fills the display line the update operation is complete on that file.	None. When the progress bar fills the display line the update operation is complete on that file. Do not turn the handset off during this operation.
Wrong Code Type	The software loaded into the handset is the wrong type for this model handset.	Verify the license type is set correctly. If the license type is correct, replace the software image on the TFTP server with the software that is correct for the handset model.
Waiting	Handset has attempted some operation several times and failed and is now waiting for a period of time before attempting that operation again.	None. The handset is waiting for a specified period of time before attempting that operation again.

Appendix A: Regulatory Domains

This table details the specifications for regulatory domain settings. Polycom recommends that you check with local authorities for the latest status of their national regulations for both 2.4 and 5 GHz wireless LANs.

Domain Identifier	802.11 Mode	Band	Channels	DFS Required?	Max. Power Limit (peak power)	Countries
01	g only b & b/g mixed	2.4000 – 2.4745 GHz	1 – 11	n/a	100mW (+20dBm)	US Canada Mexico Brazil
	a	5.1500 – 5.2500 GHz	36 – 48	No	50mW (+17dBm)	
		5.2500 – 5.3500 GHz	52 – 64	Yes	100mW (+20dBm)	
		5.4700 – 5.7250 GHz	100 – 140	Yes		
		5.7250 – 5.8250 GHz	149 – 161	No		
02	g only b & b/g mixed	2.4000 – 2.4845 GHz	1 – 13	n/a	100mW (+20dBm)	Europe Australia New Zealand
	a	5.1500 – 5.2500 GHz	36 – 48	No		
		5.2500 – 5.3500 GHz	52 – 64	Yes		
		5.4700 – 5.7250 GHz	100 – 140	Yes		
03	g only b & b/g mixed	2412.0 – 2472.0 GHz	1 – 13	n/a	100mW (+20dBm)	Japan
	a	5.1500 – 5.2500 GHz	36 – 48	No		
		5.2500 – 5.3500 GHz	52 – 64	Yes		
04	g only b & b/g mixed	2.4000 – 2.4835 GHz	1 – 13	n/a	100mW (+20dBm)	Singapore
	a	5.1500 – 5.2500 GHz	36 – 48	No		
		5.2500 – 5.3500 GHz	52 – 64	Yes		
05	g only b & b/g mixed	2.4000 – 2.4845 GHz	1 – 11	n/a	100mW (+20dBm)	Korea
	a	5.1500 – 5.2500 GHz	36 – 48	No		
		5.2500 – 5.3500 GHz	52 – 64	Yes		
		5.4700 – 5.6500 GHz	100 – 124	Yes		
		5.7250 – 5.8250 GHz	149 – 161	No		

06	g only b & b/g mixed	2.4000 – 2.4745 GHz	1 – 11	n/a	100mW (+20dBm)	Taiwan
	a	5.2500 – 5.3500 GHz	52 – 64	Yes		
		5.4700 – 5.7250 GHz	100 – 140	Yes		
		5.7250 – 5.8500 GHz	149 – 165	No		
07	g only b & b/g mixed	2.4000 – 2.4845 GHz	1 – 13	n/a	100mW (+20dBm)	Hong Kong
	a	5.1500 – 5.2500 GHz	36 – 48	No	50mW (+17dBm)	
		5.2500 – 5.3500 GHz	52 – 64	Yes	100mW (+20dBm)	
		5.4700 – 5.7250 GHz	100 – 140	Yes		
		5.7250 – 5.8250 GHz	149 – 161	No		

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